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# Performance Evaluation of DCA-GA Using Matlab

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**Abstract:** ***The channel allocation problem is a complex problem where a minimum number of channels have to be allocated. Several approaches have been proposed to solve the dynamic channel allocation (DCA). In this paper, Genetic Algorithm (GA) is a simple tool that can be used. It selects the best option from all the possible solutions, thus making it very different from all the other existing approaches. Several constraints like co channel and adjacent channel interferences have been considered while solving the channel allocation problem. The performance of the proposed GA-DCA model has been evaluated by MATLAB programming language under the effective of varying cellular capacity.***

**General Terms:** Channel allocation problem, optimization, and simulation

**Keywords:** Cellular communication, Dynamic channel allocation, Genetic algorithm, interference constraints

## 1. Introduction

Recently, the number of cellular users has grown. The channels in a cellular network can be assumed to be a frequency slot in FDMA networks, time slot in TDMA networks or a specific code in CDMA based networks. These channels must be placed some distance apart in order to avoid interference. GA is one of the best known algorithms in area of resource allocation. it is based on the principle of evolution, operations such as crossover and mutation, and the concept of fitness. in this paper, the problem of dynamic channel allocation has been portrayed as an optimization problem and solved using genetic algorithm. The next section includes the method. Section 3 result and discussion. Section 4 concludes the paper.

## 2. Method

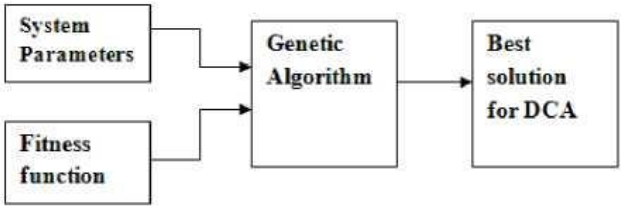


**Figure 1:** Proposed GA-DCA Model

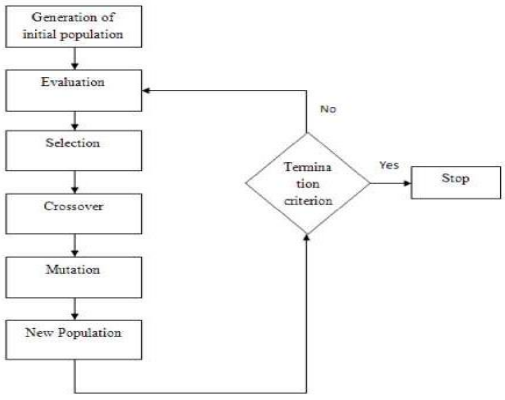


**Figure 2:** Genetic Algorithm

### 2.1 Genetic Algorithm

**Initialization**
As it can be seen from the figure, an initial population is randomly generated.

**Evaluation**
The fitness function should be formulated such that the individual chromosome is its variable input parameter.

**Selection**
Once the fitness values have been calculated, the chromosomes that correspond to the lesser fitness values can be selected.

**Crossover**
Once a portion of the population has been selected, the number of chromosomes in the initial population decrements. But the population size must be maintained throughout. For this purpose, new chromosomes have to be generated from the existing ones.

**Mutation**
Mutation is the process where only one parent is involved to form a new chromosome. Some random genes are selected for mutation or change.

**Termination**
These processes take place in an iterative manner. but certain terminating criterions are provided.

### 2.2 System Parameter

Number of cells and total number of channels must be given as input to the genetic algorithm.

### 2.3 Fitness Function

Which determines the quality of each possible solution, must also be designed and given as input to the algorithm. at the output, the best solution corresponding to the channels that must be allocated to each cell is obtained.

### 2.4 Evaluation Function

The evaluation function that determines the fitness of the chromosomes is the energy function of the model. The fitness function formulated in this paper is:

**E=CI+SI+AI**

Where:

CI=Co Ch Interference

SI=Co Site Interference

AI=Adjacent Ch Interference As the value of interference increases, the corresponding value of e also increases, which directly reflects that it becomes a less preferred option.

### 2.5 Representation

A chromosome represents a cell from the cellular network to which a call is referred, and a binary gene corresponds to a channel. The number of bits in a chromosome is the number of channels that the cell may serve. If the gene is 0, it means the channel is free and if it is 1, it means the channel is occupied.

## 3. Result and Discussion

The simulation model for GA-DCA has been implemented using Matlab programming language. For simulation simplicity, a cellular network of 4 cells has been considered. The total number of channels in the network is initially assumed to be 7.

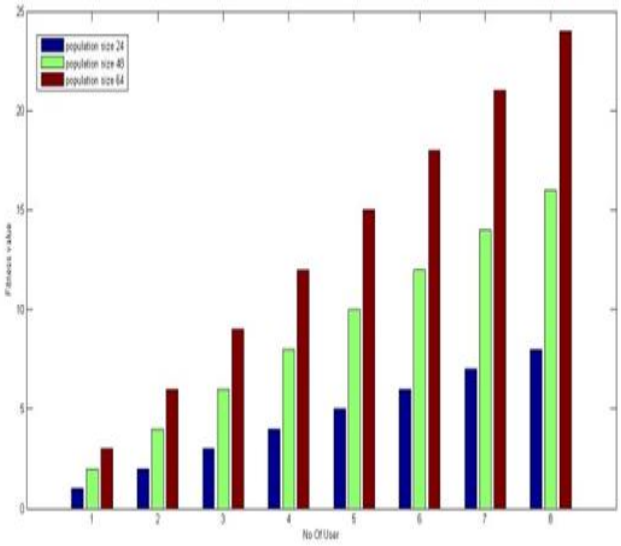


**Figure 3:** Variation of fitness with no of user

As the number of users in the cellular network increases, the interference in the network also increases. This increase in interference is directly reflected in a rise in the fitness function, as f is a function of interference. The main objective is to minimize the fitness function and maximize the number of users. For this purpose, the various parameters have to be optimized.

### 3.1Optimization Of Population Size

No channel=7, no of cell=4 and variable population size to compare the results of the various cases and thus find out the most optimized value.

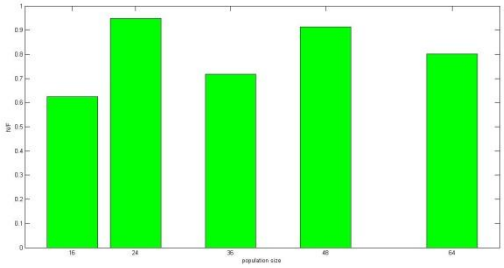


**Figure 4:** Variation of N/F with Popsize

The program was run **3** times to evaluate the results on the basis of an average value. As the input metrics is set to be random numbers, the values keep changing in each case. The number of one's represents users that were allocated channels in that particular string. The fitness function represents the interference. Hence fitness value should be as low as possible and number of users must be maximized. Thus the n/f ratio determines the goodness of the values obtained.

### 3.2Optimization of Number of Channel

Population size = 16, number of cells= 4 and maximum users =500, the program was simulated for various values of channel. For each value of cell, corresponding values of f and n were obtained. The values of n/f with varying values of number of channels have been represented in a graph form. The performance of the network with the corresponding number of channels is directly reflected in the n/f ratio. Thus higher the ratio better is the performance.

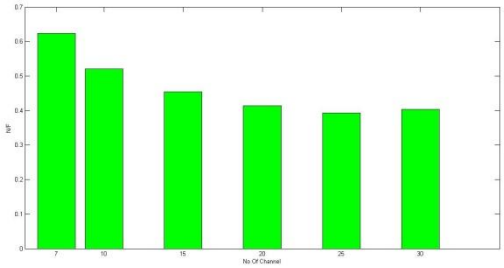


**Figure 5:** Variation of N/F with Number of Channels

The fig clearly shows that the best performance was obtained when number of channels 7 can be selected as the optimum value for no of channel.

## 4. Conclusion

The performance of GA-DCA, to solve the problem of channel allocation in mobile communication, has been implemented. The ability of genetic algorithms to search for a solution from a wide spectrum of available solutions, results compared to other channel allocation methods. The results presented shows that as the number of user's increases, the call blocking and call dropping probabilities are also increase. Thus GA tries to reduce the blocking rates,

even under conditions of high capacity. The main parameters considered in genetic algorithm are number of cells, number of channels and population size. The ratio of number of users to fitness function was also determined in each case to determine the goodness of each result. Considering a4 cell network, the optimized values obtained were 24 population sizes, 7 numbers of channels. By making use of genetic algorithm, the results were obtained faster and in a simpler way.

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